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Made from Scratch: A Sustainable Handbag Made of Bacterial Cellulose Grown in Fermenting Tea

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Using common household ingredients, bacterial cellulose, a novel sustainable material, was developed through fermentation of Kombucha tea. When harvested and dried after several weeks of growth, bacterial cellulose resembles a leather-like material that may be used as an alternative leather source for apparel and accessories. This biodegradable and renewable biomaterial has gained increasing attention in many fields in recent years due to its unique properties, such as high mechanical strength, moldability, purity, biocompatibility, and non-toxicity, which make it suitable for a variety of applications (Gama, Gatenholm, & Klemm, 2013).

A vast amount of research exists on applications of bacterial cellulose in various fields, including biomedical engineering, wound dressing, foods, cosmetics, acoustics, and other uses (Gama, Gatenholm, & Klemm, 2013); however, research in the textiles and apparel field is lacking. Increasing use of bio-based renewable materials, such as bacterial cellulose, can help reduce the apparel industry's dependence on non-renewable fiber sources and plant-based cellulose as well as decrease its negative impact on the environment. It is well documented that the apparel industry greatly contributes to environmental degradation, resource depletion, and human health problems (Dickson, Loker, & Eckman, 2009). The purpose of this work was to explore bacterial cellulose as a sustainable leather-like material for a handbag design. This exploration was carried out in two parts described below: (1) material development and (2) product design.

Material development. Common household ingredients (brewed tea, sugar, and vinegar) and commercially available bacterial cultures for Kombucha brewing were combined to prepare the growth solution for bacterial cellulose cultivation. Several plastic containers (16"x11") containing the tea solution were placed in static condition in room temperature to ferment for four weeks. During the fermentation process cellulose mats developed on the surface of the tea solution, measuring about 3/8" in thickness by the end of the fourth week. At the end of the growth period, the cellulose mats were removed from the tea solution, washed with soapy hot water and rinsed multiple times. A special surface treatment, which will be discussed in a later publication, was applied to the wet cellulose mats in order to make them pliable and soft. Afterwards, the mats were laid flat to air-dry in room temperature. In the result, naturally tan flexible material with leather-like texture and appearance was obtained. Two cellulose mats were dyed with red onion skins before drying to obtain reddish color.

Product design. The original tan color, the reddish tones of the dyed material, and the inherent organic patterns and “imperfections” on the bacterial cellulose mat surface, evocative of Western mood, inspired the selection of the saddle bag style for the handbag. Patterns were drafted and used to cut the cellulose mat pieces for the handbag construction. The flap of the bag, extending from upper back to the front, was made in double layers, overlapping the reddish and tan colors. Laser cutting and etching were used to create floral designs on the upper layer to symbolize the environmentally-friendly aspects of bacterial cellulose and the handbag. At the end of its life cycle bacterial cellulose, a biodegradable material, can become biological nutrient for future growth, when thrown away or composted (McDonough & Braungart, 2002), symbolized by the shoots and flowers in the laser-cut design. Adobe illustrator was used to create the floral patterns for laser cutter. The handbag was constructed using a home sewing machine and cotton thread. The bag was lined with heavyweight cotton canvas. Metal hardware was used in the shoulder strap for attaching it to the bag and for length adjustment.

Exploring the use of a novel sustainable material, this work adds to the existing knowledge on sustainability in the apparel and textile industries, specifically, on renewable, bio-based sources for apparel-related products. It also contributes to the limited research on bacterial cellulose development and use in the apparel field. The study demonstrated the successful use of bacterial cellulose for an intricate accessory design, as well as the applicability of regular construction and sewing techniques to bacterial cellulose material. Laser cutting technology was also successfully used to cut creative designs on bacterial cellulose mats, using settings intended for leather.

References

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Front view



Back view



Side view



Detail